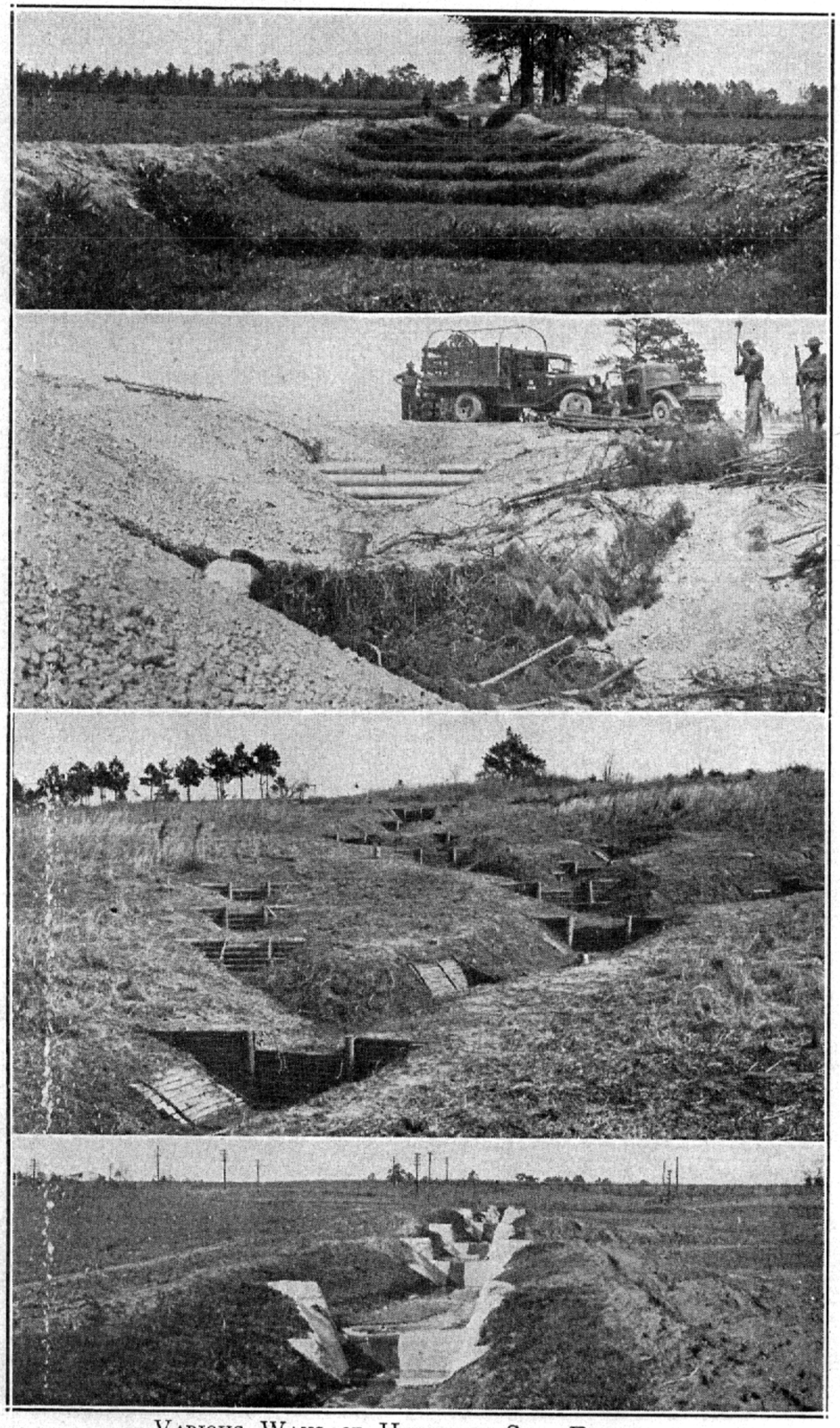

VARIOUS WAYS OF HANDLING SOIL EROSION.

December 1935

THE ENGINEERS' NEW CHALLENGE

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Epsilon, '32

The Mississippi River dumps a cubic mile of incalculably rich soil into the Gulf of Mexico every year. Winds across the semi-arid plains spread death, waste and desolation which cost $2,000,000 per day to crops and livestock farmers. Five thousand tons of dust over Washington, D. C., and six thousand tons of dust over Chicago during these storms. Dust which leads to disease, suffering and possible future national suffering caused by famine.

Down the bare sloping hillside fields run the eroding rains, like the waters of affliction. Over-cropped, gullied fields offer mute evidence to the exhaustion of life-giving organic materials. Gullies, weeds and thistles invade the fields deprived of nature's tenacious army of defense—the army of forest trees and grass.

The dust storms of the past two springs have been spectacular. but are really the lesser evils of the process which is dispossessing the richest valleys in the world—that of Old Man River and his neighbors—of an incalculably rich natural heritage.

No blanket indictment can be drawn against all parties to this despoliation. Some of it is due to a lack of responsibility toward the soil on the part of its keepers. No little can be charged to reckless exploitation for immediate cash returns, exemplified by "Why worry about the land? I can raise enough crops in three years to buy a new farm." More is due to the vast dislocation of agriculture caused by the War and its propaganda for growing more food. Most can be charged to a farm mortgage which forces the farmer to raise more and more cash crops in order to make payments on the mortgage.

The result—in the past sixty or seventy-five years about one hundred million acres of good farm land has been permanently ruined by soil erosion. This is about 30 per cent of the cultivated land of these United States. An additional one hundred and twenty-five million acres has lost its fertile top soil.

The old states of the South and Southeast use enough fertilizer to make the crop, using the subsoil only as a foothold for the cash crops, a foothold that is gradually edging toward a watery grave. The rich Midwest, the bread basket of the nation, has just commenced to use fertilizer. A vague but sinister warning.

Much can be done to put off our increasing deficit.

Broad base terraces supported by soil-building cropping practices plus re-forestation and re-pasturing is our main hope for future prosperity. Terraces are flat bottom ditches with a broad ridge of soil below, located almost on a contour of sloping fields, for the purpose of controlling the flow of rain water.

The old army-surgeon technique in so-called "Erosion Programs" was to cut, cut, cut. Call the erosion a cancer, because a cancer is a lot of energy gone wrong. Cutting out may "cure", but it certainly does not prevent reappearance. Cutting broad base terraces is not a true preventive and should not be called "control" unless terracing, crop rotation, forestation, controlled outlets, gullies protected, road ditches controlled and all other practices that go to stop erosion are included.

The U. S. Department of Agriculture was created to help the farmer by giving advice as to the best practices of farm management. This Department grew in popularity and size. Later the Extension Service was founded which went further and showed the way as well as demonstrated the best methods of improving farm incomes and maintaining soil fertility.

The Department soon realized that soil loss was an important factor in farm income decline. The terrace and crop rotations were stressed to help control this decline; however, the amount and severity of the loss was not realized until the establishment of erosion experiment stations, of which there are now ten.

For instance, at the Guthrie, Oklahoma, Erosion Experiment Station, plots have been established for measuring silt and runoff from similar areas—one terraced and one unterraced.

In other stations such as Statesville, North Carolina; Hays, Kansas; Pullman, Washington; Tyler, Texas; Temple, Texas; Bethany, Missouri; and others, information was gathered and assembled. Dr. H. H. Bennett analyzed these figures and made them public. The need of doing something immediate was very evident.

Soil Loss in Tons per Acre			Annual Runoff % of Rainfall		Average Slope in ft. per 100′		Annual Rainfall	Year
Terraced	Unterraced	Terraced in % of Unterraced	Terraced	Unterraced	Terraced	Unterraced	Inches	
1.25	43.90	2.8	10.7	22.7	5.5	5.1	27.3	1931
4.06	88.06	4.6	23.3	30.8	5.5	5.1	36.2	1932
1.33	60.39	2.2	21.9	14.1	4.6	5.1	30.4	1933
2.21	64.12	3.4	18.6	22.5			31.3	Average

Strip crops also have greatly reduced erosion on cultivated land.

Secretary of the Interior Ickes allotted $5,000,000 to expand erosion control work by demonstrations which were to be put in practice on the farmer's farm and not on government property, to demonstrate what can be done by the farmer. More money was allotted to the new department known as the Soil Erosion Service until it had received about $14,000,000 to run till June 30, 1935. Congress recently allotted $25,000,000 more under the W.P.A. Fund to carry on this popular rural work. The work has been consolidated under one department now known as the Soil Conservation Service, which has under its direction the ten Erosion Experiment Stations, forty going Erosion Demonstrational Areas and several E.C.W. (C.C.C.) Camps per state.

In order to establish the demonstrational projects, location was first considered. These projects must serve demonstrationally as much territory as possible. For instance, there are stations in the Piedmont cotton belt as at Athens, Georgia; Spartanburg, South Carolina; and Wadesboro, North Carolina; and in the Piedmont grain and tobacco sections as High Point, North Carolina. Similarly there are stations in the Blacklands of Texas, in the windblown area of Oklahoma, Texas, Kansas, and so on.

After these areas were located a map was necessary in order to help take an inventory of a farm's resources. This map should show the farms, fields, slopes, soil type, amount of erosion, etc. In order to obtain such a map it was first necessary to balance expense against details required. The result was—thirty-two million acres have been mapped by the aid of aerial photography, requiring about two years. Special apparatus was designed in order to obtain these necessary photographs. In

North Carolina the aerial maps are on a scale of five hundred feet to the inch, large enough to see gullies, trees, buildings, terraces, ditches and other pertinent details. These maps were then taken into the field by civil or agricultural engineers and the property boundary of all farms located accurately (these photographs are within 10 per cent accurate). After the farm boundaries are located, a soils expert maps the type, location and slope of the component soils of the farm, showing degree of erosion and land use. The soils man also designated the future use of the land as indicated by the soil map inventory.

Then, and if the farmer wants to proceed with the program which includes terracing, strip cropping, cover crops, crop rotations, reforestation and gully control, a man trained in farm crops and farm practices studies the man's place and problems with him, working out erosion control practices consistent with the long time income available from that farm. If the five-year agreement can be worked out satisfactorily between the farmer and the Soil Conservation Service, then it is ready for work to begin.

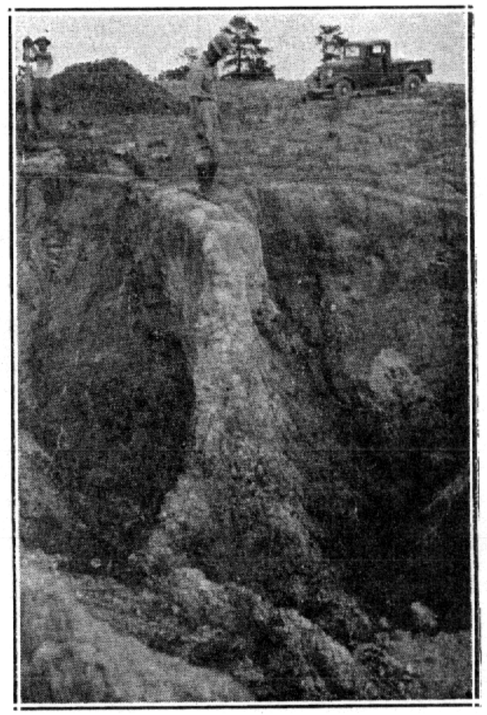
As soon as a crop comes off the land it is staked for terracing. This staking is accomplished by three men, an instrument man, a rodman, and a peg boy. The three locate the terraces and stake them off with a minimum gradient advisable for the region involved. Then the terrace is built by machinery recently developed in the Agricultural Engineering field. These terraces are eighteen to twenty-five feet wide and have an effective height of about eighteen to twenty-four inches. The resulting waterway is the largest obtainable farmable waterway consistent with reasonable costs.

The water conducted to the edge of the field is highly concentrated and would result in excessive erosion unless it is taken care of properly; i. e., running water must be forced to walk downhill to stream level—a good job and headache for the agricultural engineers and one which calls for a thorough knowledge of hydraulics.

In some cases the water may be turned into heavily vegetated woods with only a board or a few shrubs to spread the water. In another case the water may be placed in a rock, concrete, half-tile or steel flume and conducted to a natural drainageway. Full tile has been used, as have flumes designed to use

vegetation for cover and protection. Road ditches are a poor place to turn water, but in numerous cases they cannot be well avoided. If road ditches are used they must be protected.

Whenever possible, small natural valleys are used as an outlet. The drain is first seeded to a sod-forming grass and then allowed to form a sod. After the sod is formed the land is terraced and the water allowed to flow in a thin sheet over this sod. The area is usually large enough to afford some hay for feed.



Erosion Before Treatment.

The concrete, rock, steel or half-tile flume is more expensive in first cost, but requires less maintenance. These flumes are hard to design because hydraulic jump and non-streaming flow are prevalent especially when trash flows in the flume.

Strip cropping, which consists of narrow strips of close growing crops ten to fifty feet wide placed on the contour or parallel with the terraces, is practiced, thereby breaking up the concentrated flow of water.

Complete crop roation, including as much legumes and small grain as possible, is used, and the farmer is aided in getting good stands by practical demonstrations and even by improved seed and by lime.

Project demonstrations such as these are too expensive to use on all the lands in the country; hence, they were used for awakening the country to the peril of erosion and to the fact that it can be prevented.

The awakening created a demand for the work outside of the areas. This has brought about formation of Erosion Control Associations which are a form of corporation which buys and mans the necessary terracing equipment. The farmer then pays.

an hourly rate for the use of the tractor and crew (usually $2.50–$3.00). This rate is to be enough to pay for the tractor and its operation. The farmer has the advantage of the efficiency of power machinery which he could not afford to own.

The new E.C.W. organization can work out an agreement with the farmer similar to the one in the demonstrational projects. The main difference between the project and the camp, the farmer must pay for the terracing and furnish about half the material outside of the terracing in the E.C.W. Program. The E.C.W. can build terrace outlets, control gullies, move fences, help with certain types of seeding and tree planting, etc.

Thus the farmers over most sections of the United States can obtain for a reasonable cost this valuable work, which insures that his term as "keeper of the land" will be successful and leave it (to his children) as good as when it was entrusted to his care.

Thus land is a heritage which God granted us to use, live by and pass on—a heritage not to be destroyed.

We have been at a national crisis. Millions of people have been unemployed. No income, ragged, gaunt, hollow-eyed urchins living from hand to mouth or stealing in order to live. These boys have never had the chance to become self-reliant and have an income. The E.C.W. or C.C.C. gave the boys from the needy families, between eighteen and twenty-five, an opportunity to learn to work and to earn a little money to send home to the parents. Thousands have flocked to these camps to live and to learn.

The camps are out in the open. The boys work in the health-giving sun and wind, becoming sun- and wind-tanned, strong and full of vim and vigor. At first the life did not seem as wild and woolly as the men had pictured it. They found comfortable tents or bunk houses, clean beds, uniforms and abundant food. They found camp commanders and superintendents who could and did mete discipline and work. Work was limited to forty hours a week, leaving much time for study, recreation and sports.

At the present writing the Federal Government has asked that the Soil Conservation Service use a portion of those on direct relief during the coming year of 1935-36. These men will be put to work on health-giving outdoor jobs. Many will come from the mill and the factory to see the farm and learn of its trials and rewards.

What better time to make use of this excess labor than now when it is necessary to take care of it? Put it to use so that our present national resources of soil may be conserved as far as possible.

It seems scarcely necessary to add that whatever our inclinations, wherever our thoughts, conclusions or round table discussions may lead us, here is a material physical job that must be attended to if the nation is to avoid an early inconceivably bad land situation. The Union of South Africa has come to that conclusion and is now busily engaged in protecting itself, employing a plan somewhat as has been outlined.

We are only "pikers" compared to Italy which is engaged in an enormous land reclamation and conservation program (the Bonificia Integrale), the cost of which has been estimated at $500,000,000.

China is an example of free exploitation of land (her great floods killing up to one million people in one flood and equally great famines), while Japan is the antithesis—Japan, who at an expense of many times the value of the land, repairs small washes and breaks in the sod.

We, the United States, are depleting our farm and grazing lands at a rate probably exceeding that taking place anywhere else on the globe. This is the challenge to us.